Gas Drainage Practices and Experiences
About Whitehaven Coal

- Established in 1999 by proven coal developers and operators
- Listed on the ASX in June 2007 with 323 million shares on issue, currently a total of 1,025 million shares on issue and a market capitalisation of about $1.5 billion
- Whitehaven currently operates five mines – Narrabri underground mine and four open cuts – Tarrawonga, Rocglen, Werris Creek and Maules Creek
- Production of 10.3Mt in FY2014 will double to over 23Mt by FY2018
- The largest operator in the Gunnedah Basin, producing high quality thermal and metallurgical coals
- Founding shareholder of the NCIG coal terminal in Newcastle
<table>
<thead>
<tr>
<th>Location</th>
<th>Ownership</th>
<th>Reserve Duration</th>
<th>Permitted ROM</th>
<th>Planned ROM</th>
<th>Coal Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maules Creek (75%)</td>
<td>75%</td>
<td>~ 30 years</td>
<td>13 Mtpa ROM</td>
<td>13 Mtpa ROM</td>
<td>SSCC, PCI and high energy thermal</td>
</tr>
<tr>
<td>Narrabri North (70%)</td>
<td>70%</td>
<td>~ 25 years</td>
<td>8 Mtpa ROM</td>
<td>6 Mtpa ROM</td>
<td>PCI &amp; low ash thermal coals</td>
</tr>
<tr>
<td>Tarrawonga (70%)</td>
<td>70%</td>
<td>&gt; 20 years</td>
<td>3 Mtpa ROM</td>
<td>2 Mtpa ROM</td>
<td>SSCC, PCI and high energy thermal</td>
</tr>
<tr>
<td>Rocglen (100%)</td>
<td>100%</td>
<td>~ 3 years</td>
<td>1.5 Mtpa ROM</td>
<td>1.5 Mtpa ROM</td>
<td>Mainly thermal coals</td>
</tr>
<tr>
<td>Vickery (100%)</td>
<td>100%</td>
<td>~ 30 years</td>
<td>4.5 Mtpa ROM</td>
<td></td>
<td>SSCC, PCI and high energy thermal</td>
</tr>
<tr>
<td>Gunnedah CHPP (100%)</td>
<td>100%</td>
<td></td>
<td>4 Mtpa ROM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Werris Creek Mine (100%)</td>
<td>100%</td>
<td>~ 8 years</td>
<td>2.5 Mtpa ROM</td>
<td></td>
<td>PCI and thermal coals</td>
</tr>
</tbody>
</table>
Gunnedah Basin

MULLALEY SUB-BASIN

- Blackjack formation
- Hoskissons seam

Mining has been conducted at
- Narrabri Underground Mine
- Sunnyside open cut
- Former Gunnedah Colliery

MAULES CREEK SUB-BASIN

- Rocglen Open Cut
- Tarrawonga Open Cut
- Maules Creek Open Cut
Hoskisson Seam

- Raw Ash 11%
- Volatiles 28 – 30%
- Sulphur 0.37%
- Calorific Value (gad) of 6,950 kcal/kg
- Full Seam Thickness 9m
- Seam Working Section 3.5-4.2m
- 4.3m longwall mining section
- Producing PCI and low-ash thermal product
Narrabri Coal Operations

- Located 28km south of Narrabri
- Narrabri is producing a high energy export thermal coal and a low ash, low sulphur, low phosphorus, mid volatile PCI coal.
- First development coal was produced in FY2011 with full commercial production from the longwall achieved in October 2012.
- Production for FY2014 was 5.6Mt
- Production for FY2015 is forecast at 7.0Mt
Mine Plan

- 20 Longwall block design
- Currently mining 300m wide LW panels
- LW107 will be first 400m LW face
- MG106 is first 3 heading gateroad
- Production parameters;
  - ROM 7 to 8Mtpa
  - Up to 100m pw retreat on LW
  - 20 to 22km development pa
Mine Equipment

- Fully automated CAT longwall
  - 146 x 1,370t shields
  - CAT EL 3000 shearer
  - 3,500tph nominal face capacity
- 4 x Joy Development kits (3 running any one time)
  - 12CM12 Continuous Miner
  - 10SC32 Shuttle cars
  - Joy Feeder / Breakers
Ventilation

- Single upcast shaft – 450m³/s
- Flanking Main returns
- Bleeder surface fan – 15m³/s exhaust
- Simple “U” ventilation – 125m³/s
- Aux TG blower fan – additional 15-20m³/s into TG

Goaf drainage plant utilised – capacity 1,800lps

3 x liquid ring pump central gas extraction plan utilised for pre drainage (1,500lps)
The Hoskissons Seam is potentially outburst prone. The seam gas content is predominantly carbon dioxide (CO2) (approximately 90%).

- Insitu gas contents in current mining areas range from 5m3/t CO2 to 9m3/t.
- Future mining areas have insitu contents >10m3/t
- Seam is liable to spontaneous combustion
- Permeability is 3 to 7 mD

**Issues;**
- Outburst risk
- Gas emissions in LW return

<table>
<thead>
<tr>
<th>Gas Contents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;6m3/t</td>
<td></td>
</tr>
<tr>
<td>6 to 7m3/t</td>
<td></td>
</tr>
<tr>
<td>7 to 8m3/t</td>
<td></td>
</tr>
<tr>
<td>8 to 9m3/t</td>
<td></td>
</tr>
<tr>
<td>&gt;10m3/t</td>
<td></td>
</tr>
</tbody>
</table>
Outburst Thresholds

Level 1 DTV is 6.20 m³/t

Normal mining

- Cores at 100m spacing
- Cores at 50m spacing's if content > 5.35 m³/t or anomalies
- Cores at 5m intervals around known faults
- Cores at 10m intervals around predicted faults
- Coring at upper and lower horizons in the seam
Level 1 DTV is 7.05 m$^3$/t

Controlled mining will be allowed between 6.20 m$^3$/t and 7.05 m$^3$/t
  - Increased drilling is required, boreholes must be no more than 20m apart

Where structure is known, or can not be disproven, face advance is limited to;
  - 2m per cutting hour

Prior to working in Level 1 DTV conditions all persons working within those conditions must be trained at intervals of no more than 6 months in;
  - Outburst Mining Procedure;
  - Outburst awareness and indicators;
  - SCSR Use; and
  - CABA Use

Outburst Thresholds
Outburst Thresholds

NO NORMAL MINING ABOVE 7.05 m3/t

No mining where people are present at the face while winning coal will be allowed.

Any remote mining in areas above 7.05 m3/t will be addressed on a case by case basis and require formal risk assessment.
Authority to Mine

- No mining will take place in any development or longwall panel except in accordance with the current Authority To Mine.
- The Outburst Risk Review Committee administer the ATM process.
- Each Authority To Mine must include the following information:
  - A plan of the area showing existing and proposed workings
  - All UIS, SIS and vertical drill holes
  - An indication of all sections of boreholes that are not surveyed
  - The location of drilling anomalies along each hole
  - The location of core samples and subsequent gas analysis results
  - Details of any lost drilling equipment
  - Known and projected geological structures
  - Distances of authorised drivages
In addition, a Gas Drainage and Geological Checklist completed and signed as correct by the Gas Drainage Coordinator and Mine Geologist must accompany every ATM. The checklist must contain the following information:

- whether pre-drainage of the area has been conducted
- if pre-drainage has been conducted, the time for which the area has been pre-drained
- identify any in seam holes that have not been surveyed
- confirm that all in seam holes that are to be intersected by mining have been inspected for blockage and the result of such inspections
- whether gas flow monitoring of each drainage hole has indicated any possible blockage or other anomaly during its drainage life
- identify any anomalous data based on content, composition, DRI, IRD30 or any other factor
- a description of projected geological structures
- status of surface to seam vertical bore holes
- identification of possible inrush sources
uis Drilling

- Contract services provided through ADS
- 3 Drill rigs
- 46 personnel
- Drilling 17 to 22km per month total (180km in last 12 months)
Drainage Design

UIS Gateroad drainage

SIS Drainage

UIS compliance

UIS LW drainage
Challenges

- Extensive drilling program in seam liable to spontaneous combustion
  - Management of boreholes post-intersection

- Rapid mine advance rates vs capability of drilling/ drainage program lead time requirements

- UIS compliance coring for 400m wide faces –
  - initially restricted to 400m due to core retrieval time
  - currently recovering cores up to 650m for ATM sampling
  - cores retrieved up to 1100m for exploration

- Outburst potential in thick seam – does it present the same hazard as the Bulli seam?
Thank you